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**PCT**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

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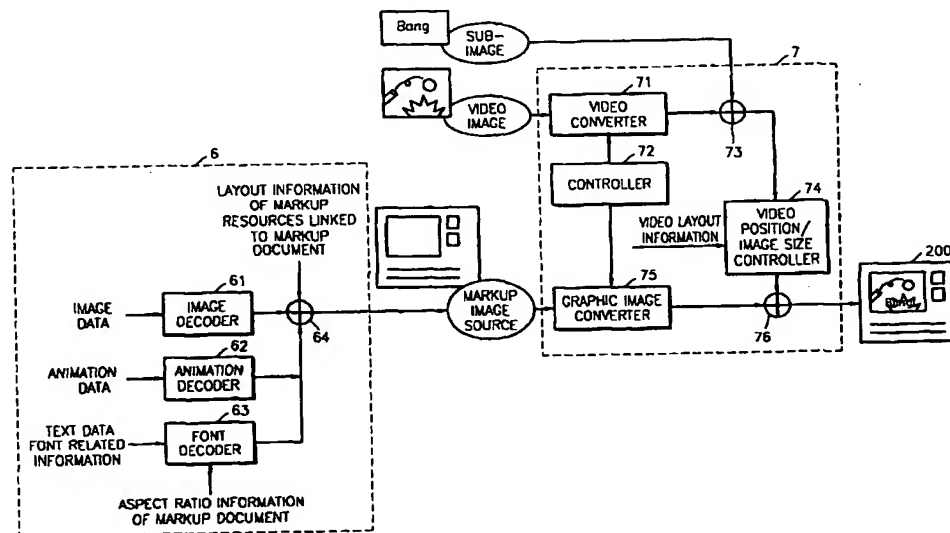
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**(57) Abstract:** An apparatus and method for reproducing an interactive content with control of a font according to an aspect ratio conversion are provided. The apparatus reproduces an interactive content from an information storage medium. The interactive content includes AV data including audio data and video data, a markup document, and/or a markup resource file. The apparatus includes a font decoder, which determines a pixel aspect ratio of a font according to aspect ratio information and resolution information of an input markup document, enlarges or reduces the font before displaying it, and outputs font data resulting from the enlargement or reduction to a screen on which the interactive content is displayed so as to be adapted to an aspect ratio and a resolution of the screen. Accordingly, the interactive content can be displayed with a minimum distortion.

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## APPARATUS AND METHOD FOR REPRODUCING INTERACTIVE CONTENTS BY CONTROLLING FONT ACCORDING TO ASPECT RATIO CONVERSION

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### Technical Field

The present invention relates to a technique of reproducing an interactive content for interactive display from an information storage medium, and more particularly, to an apparatus and method for reproducing an interactive content by controlling a font according to an aspect ratio conversion, thereby minimizing display distortion.

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### Background Art

Generally, audio and/or video (AV) content information and user definition information are recorded on an information storage medium. The AV content information is a content actually reproduced from the information storage medium, and the user definition information is unique information defined by a producer. When a general reproducing apparatus is used, only the AV content is reproduced from the information storage medium. When a device such as a computer is used, the user definition information can also be accessed and used.

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Recently, interactive information storage media have been commercialized. The interactive information storage media can be used in a web-based environment using HyperText Markup Language (HTML) enabling a user interactive display. When information is reproduced from an interactive information storage medium, even when a general reproducing apparatus is used, a user can see an interactive image showing a tool, a text, or an image, which enables the user to access a network link and perform a search, together with an AV image showing an AV content.

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FIGS. 1A and 1B show examples of a screen which can be

displayed in an interactive mode. FIG. 1A shows a screen having an aspect ratio of 4:3 (hereinafter, referred to as a 4:3 screen). FIG. 1B shows a wide screen having an aspect ratio of 16:9.

Conventional interactive information storage media are  
5 manufactured to have a markup document suitable only for a 4:3 screen having a pixel aspect ratio of 1:1, such as a screen of a personal computer's monitor. Accordingly, when an interactive image is displayed on a screen of a television (TV), the interactive image is displayed in an undesired format because the TV screen does not have  
10 a 1:1 pixel aspect ratio, and accordingly has a different screen aspect ratio. In other words, when an HTML file suitable for a screen having a particular pixel aspect ratio is reproduced from a conventional interactive information storage medium and displayed on a screen (e.g., a 4:3 TV screen) having a different pixel aspect ratio from the particular pixel  
15 aspect ratio, the HTML file is not displayed in a format desired by a content producer, as shown in FIG. 2.

When an interactive image is displayed on a display apparatus having a different pixel aspect ratio, image distortion occurs and the image has a different shape from that desired by a content producer. Therefore,  
20 there is a need for a method of displaying an interactive content in a format desired by a content producer without distortion on a screen having a pixel aspect ratio different from that of a produced markup document.

## 25 Disclosure of the Invention

The present invention provides an apparatus and method for reproducing an interactive content by controlling a font according to an aspect ratio conversion, thereby minimizing display distortion.

The present invention also provides an apparatus and method for  
30 reproducing an interactive content by controlling a size of a font adapted to an aspect ratio conversion using aspect ratio information of a markup

document containing the aspect ratio information and resolution information which are optimally suitable for the markup document, thereby minimizing display distortion.

5 The present invention also provides an apparatus and method for reproducing an interactive content by enlarging or reducing a font having a predetermined pixel aspect ratio according to a resolution and an aspect ratio of a screen on which the font is to be displayed, thereby minimizing display distortion.

10 According to an aspect of the present invention, there is provided an apparatus for reproducing an interactive content from an information storage medium. The interactive content includes AV data including audio data and video data, a markup document, and/or a markup resource file. The apparatus includes a font control means, which  
15 determines a pixel aspect ratio of a font according to aspect ratio information and resolution information of an input markup document, performs a preprocess of enlarging or reducing a size of the font according to the determined pixel aspect ratio, and outputs the preprocessed font data adaptive to a change in the aspect ratio and resolution of the screen on which the interactive content is displayed.

20 According to an aspect of the present invention, there is provided a method of reproducing an interactive content from an information storage medium. The interactive content includes AV data including audio data and video data, a markup document, and/or a markup resource file. The method includes determining a pixel aspect ratio of a  
25 font according to aspect ratio information and resolution information of an input markup document, performing a preprocess of enlarging or reducing the font before displaying it, and outputting the preprocessed font data adapted to an aspect ratio and a resolution of a screen on which the interactive content is displayed.

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#### Brief Description of the Drawings

The above and other features and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIGS. 1A and 1B show examples of a screen which can be displayed in an interactive mode;

FIG. 2 shows an example of distortion occurring when an image suitable for a screen having a 1:1 pixel aspect ratio is displayed on a screen having a 4:3 pixel aspect ratio without conversion;

FIG. 3 is a block diagram of a reproducing apparatus to which the present invention is applied;

FIG. 4 is a block diagram of an apparatus for reproducing an interactive content by controlling a font according to an aspect ratio conversion, according to an embodiment of the present invention;

FIG. 5 illustrates rotation of a font using control point data of font outline;

FIGS. 6A and 6B show examples of font outputs according to prior art and the present invention, respectively;

FIG. 7A and 7B show other examples of font outputs according to prior art and the present invention, respectively;

FIGS. 8A through 8C show other examples of font outputs according to the present invention and prior art; and

FIG. 9 is a flowchart of a method of reproducing an interactive content by controlling a font according to an aspect ratio conversion, according to an embodiment of the present invention.

#### Best mode for carrying out the Invention

Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the attached drawings.

FIG. 3 is a block diagram of a reproducing apparatus to which the present invention is applied. The reproducing apparatus includes a reader 1, a buffer memory 2, a cache memory 3, a decoder 4, a control

unit 5, and a blender 7. The control unit 5 is provided with a presentation engine 6. The reader 1 includes an optical pickup unit (not shown), which reads data by radiating a laser beam onto an interactive information storage medium 100.

5       The interactive information storage medium 100 provides various types of information and AV contents, which can be displayed in a user interactive environment. The interactive information storage medium 100 has a markup document containing indication information on a resolution and an aspect ratio of the markup document so that an  
10       interactive image can be appropriately displayed at a particular screen aspect ratio. Generally, a font having a square pixel aspect ratio is used in a markup document, but a format of the font may vary with content producers.

      The reader 1 controls the optical pickup unit to read AV data and  
15       a markup document from the interactive information storage medium 100 according to a control signal from the control unit 5. The buffer memory 2 buffers the AV data, and the cache memory 3 caches a playback control information file for controlling the playback of the AV data and/or the markup document or caches other necessary information. The  
20       control unit 5 controls the reader 1, the decoder 4, the presentation engine 6, and the blender 7 so that the AV data is reproduced from the interactive information storage medium 100 in a video mode or an interactive mode according to a user's selection.

      The presentation engine 6 is an analytical engine analyzing  
25       markup languages and program languages such as JavaScript and Java. The presentation engine 6 may include various plugins. The plugins enable users to open markup resource files of various formats, which are included in or linked to markup documents. In other words, the presentation engine 6 serves as a markup document viewer. In an  
30       embodiment of the present invention, the presentation engine 6 can access the Internet and read predetermined data.

The presentation engines 6 fetches a markup document from the cache memory 3 and then analyzes and renders it in the interactive mode. The blender 7 blends an AV data stream and the rendered markup document so that the AV data stream is displayed on a display window defined by the markup document, that is, an AV image is embedded in a markup document image, and outputs the result of blending to a display apparatus 200.

In particular, the presentation engine 6 enlarges or reduces a font made at a square pixel aspect ratio using aspect ratio information of a markup document containing resolution information and the aspect ratio information which are suitable for the markup document in order to minimize distortion of interactive data. As a result, the interactive data can be displayed in the original font on a screen having a different resolution and aspect ratio from the original resolution and aspect ratio of the markup document with distortion.

FIG. 4 is a block diagram of an apparatus for reproducing an interactive content with control of a font according to an aspect ratio conversion, according to an embodiment of the present invention. In FIG. 4, a sub-image is sub picture data overlapping a video image. The sub-image and the video image are provided from the decoder 4 shown in FIG. 3.

A video converter 71 is controlled by a controller 72 to convert a format of the video image into a pan & scan format or a letterbox format according to a screen aspect ratio and a resolution of the display apparatus 200 or to output the video image from the decoder 4 as it is without converting it. A first mixer 73 mixes the video image from the video converter 71 and the sub-image. A video position/image size controller 74 controls a position of the mixed image from the first mixer 73 and a size of an AV image displayed on a screen of the display apparatus 200 according to input video layout information.

A graphic image converter 75 is controlled by the controller 72 to



convert a size (a length or a width) of a graphic image of a markup image source provided from the presentation engine 6 according to aspect ratio information of a document. A second mixer 76 mixes an output of the video position/image size controller 74 and an output of the graphic image converter 76 and outputs the result of mixing to the display apparatus 200 so that the result of mixing can be displayed on the screen of the display apparatus 200. The controller 72 controls the video converter 71 and the graphic image converter 75 according to the screen aspect ratio and the resolution of the display apparatus 200. The video converter 71, the controller 72, the first mixer 73, the video position/image size controller 74, the graphic image converter 75, and the second mixer 76 constitute the blender 7.

Meanwhile, it is preferable that an interactive image display file is a markup document, such as a web-based document file, made using a markup language or a markup resource file, such as an image, an animation, or a font.

Although not shown, the presentation engine 6 includes a markup document parser and a style sheet parser. A markup document is parsed by the markup document parser to generate a document tree, which conforms the following rules. Firstly, a root node of all nodes is set as a document node. Secondly, all of texts and elements generate a node. Thirdly, a processing instruction, a comment, and a document type generate a node. The style sheet parser parses a style sheet, which allows a format of the markup document to be freely set, to generate a style rule and a selector list. The style sheet parser provides the video layout information input to the video position/image size controller 74 and layout information of markup resources linked to the markup document (referred to as markup resource layout information). The markup resource layout information is input to a markup image mixer 64.

Based on the document tree, an image decoder 61 decodes

image data, an animation decoder 62 decodes animation data, and a font decoder 63 decodes text data according to font-related information to provide text data having an appropriate font. The font-related information may include unicode information (font information for international standardization) and font family information or may be font  
5 information stored in a reproducing apparatus as default.

Particularly, in the present invention, the font decoder 63 enlarges or reduces a font using a matrix value previously set for the screen aspect ratio of the display apparatus 200 based on aspect ratio  
10 information of the markup document output from the markup document parser, and outputs font data. The operation of the font decoder 63 will be described in detail later with reference to FIGS. 5 through 9.

The markup image mixer 64 mixes outputs of the image decoder 61, the animation decoder 62, and the font decoder 63 according to the  
15 markup resource layout information to generate a markup image source and provides the markup image source to the graphic image converter 75 of the blender 7.

The image decoder 61, the animation decoder 62, the font decoder 63, the markup image mixer 64, and other units (not shown)  
20 constitute the presentation engine 6.

Preferably, a markup document displayed in an interactive image contains resolution information and aspect ratio information indicating a 16:9 screen, a 4:3 screen, a 1:1 screen, or no-relation to the screen aspect ratio which includes a case where no aspect ratio is set for the  
25 markup document. Table 1 shows examples of the resolution information and the aspect ratio information. When the markup document contains neither the resolution information nor the aspect ratio information, basic screen information set in a reproducing apparatus can be utilized. For example, the basic screen information may include a  
30 horizontal resolution of 720 pixels, a vertical resolution of 480 pixels, and an aspect ratio of 14:9.

Table 1

Pixel aspect ratio	1:1	0.888:1	1.186:1	Only resolution without pixel aspect ratio is set
Examples of use	R720×405, A1×1 R720×540, A1×1 R1920×1080, A1×1	R720×480, A4×3 R720×576, A4×3	R720×480, A16×9 R720×576, A16×9	R720×480 R720×576 R1920×1080 R960×540

The resolution information and the aspect ratio information of the markup document can be embedded into the markup document using a tag, for example, `<meta name="bestlook" content="Rresolution value,Aaspect ratio value">`. In an example of modification, `<link href="foo.css" type="text/css" device-aspect-ratio="aspect ratio value"/>` may be used. The resolution information and the aspect ratio information indicate a resolution and an aspect ratio at which the markup document is displayed most optimally. The following is an example of a markup document in which an aspect ratio and a resolution are combined.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//DVD/DTD XHTML DVD-HTML1.0//EN"
"http://www.dvdforum.org/enav/dvdhtml-1.0.dtd">
<html>
<head>
<title>720x480, 4x3 PAGE</title>
<meta name="bestlook" content="R720x480,A4x3"/>
<link href="foo.css" type="text/css" device-aspect-ratio="4:3"/>
<script language="ecmascript">
<![CDATA[
function onload_handler()
{
    idplayer.play();
    idplayer.enable VideoTransform(0);
    //Disable first video transform when a value is 0 and enable first video transform when
    a value is 1.
}

]]>
</script>
</head>
</body id=" docbody" onload="onload_handler()">
<objet style=" position: absolute; left: 150px; top: 100px; width: 370px; height:250px"
```

```

data="dvd:video_ts" id="idplayer"/>
Interactive Data
</body>
</html>

```

Generally, fonts are produced on a screen having a 1:1 (square) pixel aspect ratio. Information on a font is composed of a coordinate point, and thus a two-dimensional transformation such as enlargement, reduction, or rotation can be easily performed using control point data of a font outline, as shown in FIG. 5.

However, a TV screen does not have the square pixel aspect ratio. As shown in Table 2, when a screen aspect ratio is 4:3, a pixel aspect ratio is 0.888:1. When a screen aspect ratio is 16:9, a pixel aspect ratio is 1.186:1.

Table 2

Screen aspect ratio at 720×480 (NTSC)	4:3	16:9
Pixel aspect ratio	0.888:1	1.186:1

Accordingly, when a font having the square pixel aspect ratio (hereinafter, referred to as a 1:1 font) is output to the TV screen without being changed, phenomena described below occur.

As shown in FIG. 6A, when a 1:1 font is output to a screen having a pixel aspect ratio of 0.888:1 (i.e., a screen having a resolution of 720×480 and a screen aspect ratio of 4:3) without being converted, the 1:1 font becomes narrow. When an interactive content is displayed, if the 1:1 font is enlarged at a ratio of 1.125:1 and then output to the screen having a pixel aspect ratio of 0.888:1, the 1:1 font can be displayed normally. Accordingly, the font decoder 63 enlarges the 1:1 font at the ratio of 1.125:1 using matrix information and then outputs the enlarged font to the 4:3 screen so that the font can be displayed normally.

In other words, the enlarged font is reduced at a ratio of 0.999:1 on the screen having a pixel aspect ratio of 0.888:1 (i.e., the screen having a resolution of 720×480 and a screen aspect ratio of 4:3) and thus looks like the 1:1 font, as shown in FIG. 6B.

As shown in FIG. 7A, when a 1:1 font is output to a screen having a pixel aspect ratio of 1.186:1 (i.e., a screen having a resolution of 720×480 and a screen aspect ratio of 16:9) without being converted, the 1:1 font becomes wide. When an interactive content is displayed, if the 1:1 font is reduced at a ratio of 0.843:1 and then output to the screen having a pixel aspect ratio of 1.186:1, the 1:1 font can be displayed normally. Accordingly, the font decoder 63 reduces the 1:1 font at the ratio of 0.843:1 using matrix information and then outputs the reduced font to the 16:9 screen so that the font can be displayed normally. In other words, the reduced font is enlarged at a ratio of 0.999:1 on the screen having a pixel aspect ratio of 1.186:1 (i.e., the screen having a resolution of 720×480 and a screen aspect ratio of 16:9) and thus looks like the 1:1 font, as shown in FIG. 7B.

FIG. 8A shows an example of text data normally displayed when the font decoder 63 enlarges or reduces a 1:1 font according to a screen aspect ratio. FIG. 8B shows an example of the text data narrowly displayed when the 1:1 font is output to a screen having a pixel aspect ratio of 0.888:1 (i.e., a screen having a resolution of 720×480 and a screen aspect ratio of 4:3) without being converted. FIG. 8C shows an example of the text data widely displayed when the 1:1 font is output to a screen having a pixel aspect ratio of 1.186:1 (i.e., a screen having a resolution of 720×480 and a screen aspect ratio of 16:9) without being converted.

The font decoder 63 stores values for enlarging or reducing a font according to aspect ratio information contained in a markup document as matrix information, as shown in Table 3. Table 3 shows a matrix used for a 4:3 screen (having a pixel aspect ratio of 0.888:1 and a resolution of 720×480), a matrix used for a 16:9 screen (having a pixel aspect ratio of 1.186:1 and a resolution of 720×480), a matrix used for a basic 14:9 screen (having a pixel aspect ratio of 1.031:1 and a resolution of 720×480), and a matrix used for a screen having a pixel aspect ratio of

1:1 (wherein a resolution is 960×540 or 1920×1080).

Table 3

Pixel aspect ratio	0.888:1	1.186:1	1.031:1	1:1
Matrix information	$\begin{bmatrix} 1.125 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 0.843 & 0 \\ 0 & 1 \end{bmatrix}$	$\begin{bmatrix} 0.3 & 0 \\ 0 & 1.0 \end{bmatrix}$	$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

FIG. 9 is a flowchart of a method of reproducing an interactive content by controlling a font according to an aspect ratio conversion, according to an embodiment of the present invention. FIG. 9 shows an example of the operation of the font decoder 63 implemented in software.

It is determined whether a markup document contains aspect ratio information, for example, whether a markup document contains a tag `<meta name="bestlook" content="Rresolution value,Aspect ratio value">` or a modified tag `<link href="foo.css" type="text/css" device-aspect-ratio="aspect ratio value"/>` (901). When it is determined that the markup document contains the aspect ratio information, the aspect ratio information is input as screen aspect ratio information (902). When it is determined that the markup document does not contain the aspect ratio information, basic screen aspect ratio information set in a reproducing apparatus is input as the screen aspect ratio information (903). A font is enlarged or reduced using matrix information (as shown in FIG. 3) corresponding to the screen aspect ratio information (904). Then, font data composed of control points resulting from the enlargement or reduction of the font is rasterized for display (905). Thereafter, the rasterized font data is mixed with other elements (an image, animation, etc.), and the result of mixing is displayed on a screen (906).

#### Industrial Applicability

As described above, according to the present invention, when interactive image information optimally displayed at a particular aspect

ratio is reproduced from an information storage medium and displayed on a screen having a different screen aspect ratio from the particular aspect ratio, a font is enlarged or reduced using matrix information corresponding to the particular aspect ratio, so that the original font  
5 desired by a content producer can be normally displayed on the screen, and an interactive image can be displayed on the screen with a minimum distortion.

What is claimed is:

1. An apparatus for reproducing an interactive content from an information storage medium, the interactive content including AV data including audio data and video data, a markup document, and/or a markup resource file, the apparatus comprising a font control means, which determines a pixel aspect ratio of a font according to aspect ratio information and resolution information of an input markup document, performs a preprocess of enlarging or reducing a size of the font according to the determined pixel aspect ratio, and outputs the preprocessed font data adaptive to a change in the aspect ratio and resolution of the screen on which the interactive content is displayed.
2. The apparatus of claim 1, wherein the aspect ratio information is embedded in the markup document using a tag.
3. The apparatus of claim 2, wherein the markup document contains resolution information and screen aspect ratio information indicating a 16:9 screen, a 4:3 screen, a 1:1 screen, or no-relation to the screen aspect ratio which includes a case where no aspect ratio is set for the markup document.
4. The apparatus of claim 2, wherein when the tag for the aspect ratio information of the markup document does not exist in the markup document, basic screen aspect ratio information set in the reproducing apparatus is used as screen aspect ratio information of the markup document.
5. The apparatus of claim 1, wherein the font control means stores matrix information indicating values for enlarging or reducing the font according to the aspect ratio information of the markup document.



6. The apparatus of claim 5, wherein the matrix information comprises a matrix used for an aspect ratio of 4:3, a matrix used for an aspect ratio of 16:9, a matrix used for a basic aspect ratio of 14:9, and a matrix used for an aspect ratio of 1:1.

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7. An apparatus for reproducing an interactive content from an information storage medium, the interactive content including AV data including audio data and video data, a markup document, and/or a markup resource file, the apparatus comprising:

10 a reader, which reads data from the information storage medium;  
and

a presentation engine, which enlarges or reduces a font, made at a predetermined pixel aspect ratio, using aspect ratio information of the markup document read by the reader, the markup document containing  
15 the aspect ratio information and resolution information which are optimally suitable to the markup document, and outputs the enlarged or reduced font adaptive to a screen having a different aspect ratio and resolution from the aspect ratio information and the resolution information contained in the markup document with a minimum  
20 distortion.

8. The apparatus of claim 7, wherein the aspect ratio information is embedded in the markup document using a tag.

25

9. The apparatus of claim 8, wherein when the tag for the aspect ratio information of the markup document does not exist in the markup document, basic screen aspect ratio information set in the reproducing apparatus is used as screen aspect ratio information of the markup document.

30

10. The apparatus of claim 9, wherein the presentation engine

comprises a font decoder, which stores matrix information indicating values for enlarging or reducing the font according to the aspect ratio information of the markup document.

5           11. The apparatus of claim 10, wherein the matrix information comprises a matrix used for an aspect ratio of 4:3, a matrix used for an aspect ratio of 16:9, a matrix used for a basic aspect ratio of 14:9, and a matrix used for an aspect ratio of 1:1.

10           12. The apparatus of claim 7, wherein the markup document contains resolution information and screen aspect ratio information indicating a 16:9 screen, a 4:3 screen, a 1:1 screen, or no-relation to the screen aspect ratio which includes a case where no aspect ratio is set for the markup document.

15           13. The apparatus of claim 12, wherein when the screen aspect ratio information indicates the 4:3 screen, the font decoder enlarges a font having a square pixel aspect ratio to have a first ratio and outputs the enlarged font to the 4:3 screen so that the enlarged font  
20           having the first ratio is reduced and displayed at almost the square pixel aspect ratio on the 4:3 screen.

          14. The apparatus of claim 12, wherein when the aspect ratio information indicates the 16:9 screen, the font decoder reduces a font,  
25           having a square pixel aspect ratio to have a second ratio and outputs the reduced font to the 16:9 screen so that the reduced font having the second ratio is enlarged and displayed at almost the square pixel aspect ratio on the 16:9 screen.

30           15. The apparatus of claim 7, further comprising:  
          a decoder, which decodes the AV data read by the reader and

outputs a video image and a sub-image; and

a blender, which blends the AV data and a rendered markup document so that the AV data is displayed on a display window defined by the markup document,

5 wherein the blender comprises:

a video converter, which converts a format of the video image into a pan & scan format or a letterbox format according to a screen aspect ratio and a resolution of a display apparatus or outputs the video image as it is without converting it;

10 a first mixer, which mixes the video image from the video converter and the sub-image;

a video position/image size controller, which controls a position of the mixed image from the first mixer and a size of an AV image displayed on a screen of the display apparatus according to input video layout  
15 information;

a graphic image converter, which converts a size of a graphic image of a markup image source provided from the presentation engine;

a second mixer, which mixes an output of the video position/image size controller and an output of the graphic image  
20 converter and outputs the result of mixing to the display apparatus so that the result of mixing can be displayed on the screen of the display apparatus; and

a controller, which controls the video converter and the graphic image converter according to the screen aspect ratio and the resolution  
25 of the display apparatus.

16. A method of reproducing an interactive content from an information storage medium, the interactive content including AV data including audio data and video data, a markup document, and/or a  
30 markup resource file, the method comprising:

determining a pixel aspect ratio of a font according to aspect ratio

information and resolution information of an input markup document;  
performing a preprocess of enlarging or reducing the font before  
displaying it; and  
outputting the preprocessed font data adapted to an aspect ratio  
5 and a resolution of a screen on which the interactive content is  
displayed.

17. The method of claim 16, wherein the aspect ratio  
information of the markup document is embedded in the markup  
10 document using a tag.

18. The method of claim 17, wherein determining the pixel  
aspect ratio comprises setting basic screen aspect ratio information set  
in the apparatus as screen aspect ratio information of the markup  
15 document when the tag for the aspect ratio information of the markup  
document does not exist in the markup document.

19. The method of claim 18, wherein the markup document  
contains the resolution information and the aspect ratio information  
20 indicating a 16:9 screen, a 4:3 screen, a 1:1 screen, or no-relation to the  
screen aspect ratio which includes a case where no aspect ratio is set for  
the markup document.

20. The method of claim 16, wherein enlarging or reducing the  
25 font comprises converting the font using matrix information indicating  
values for enlarging or reducing the font according to the aspect ratio  
information of the markup document.

21. The method of claim 20, wherein the matrix information  
30 comprises a matrix used for an aspect ratio of 4:3, a matrix used for an  
aspect ratio of 16:9, a matrix used for a basic aspect ratio of 14:9, and a

matrix used for an aspect ratio of 1:1.

22. The method of claim 20, wherein when the screen aspect ratio information indicates the 4:3 screen, enlarging or reducing the font comprises enlarging a font having a square pixel aspect ratio to have a first ratio, and outputting the font data comprises outputting the enlarged font to the 4:3 screen, so that the enlarged font having the first ratio is reduced and displayed at almost the square pixel aspect ratio on the 4:3 screen.

10

23. The method of claim 20, wherein when the aspect ratio information indicates the 16:9 screen, enlarging or reducing the font comprises reducing a font having a square pixel aspect ratio to have a second ratio, and outputting the font data comprises outputting the reduced font to the 16:9 screen, so that the reduced font having the second ratio is enlarged and displayed at almost the square pixel aspect ratio on the 16:9 screen.

15

1/7

FIG. 1A

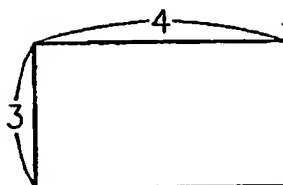


FIG. 1B

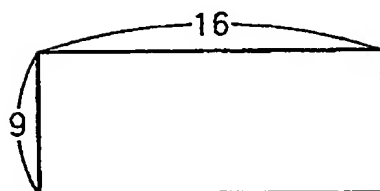
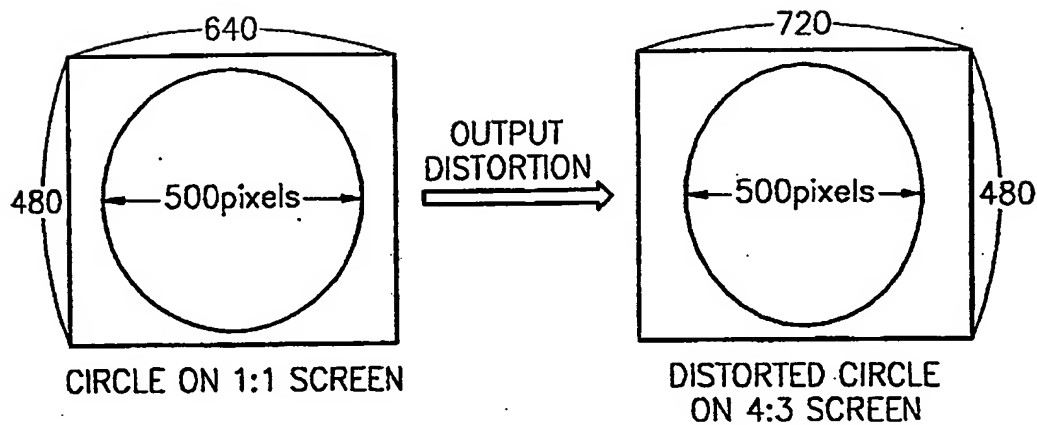


FIG. 2



2/7

FIG. 3

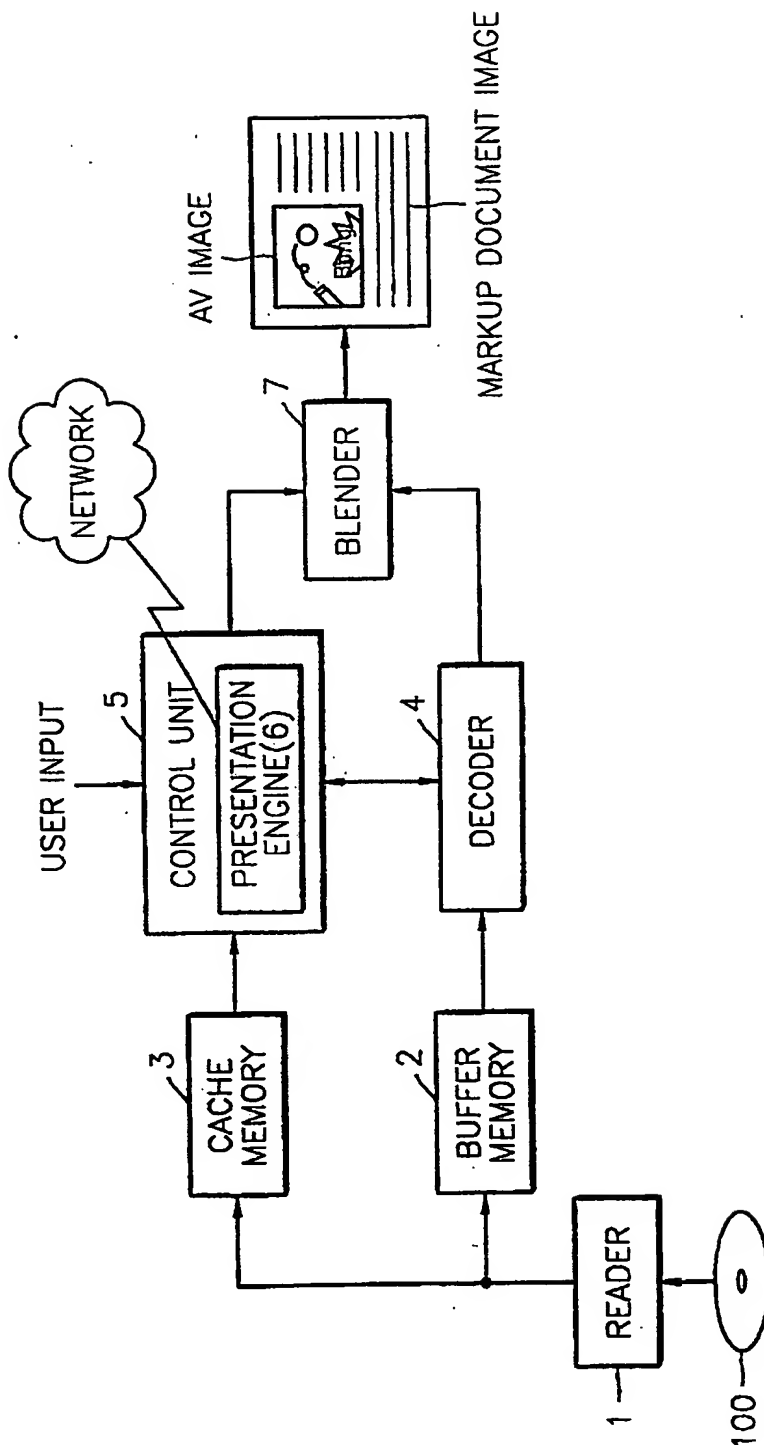
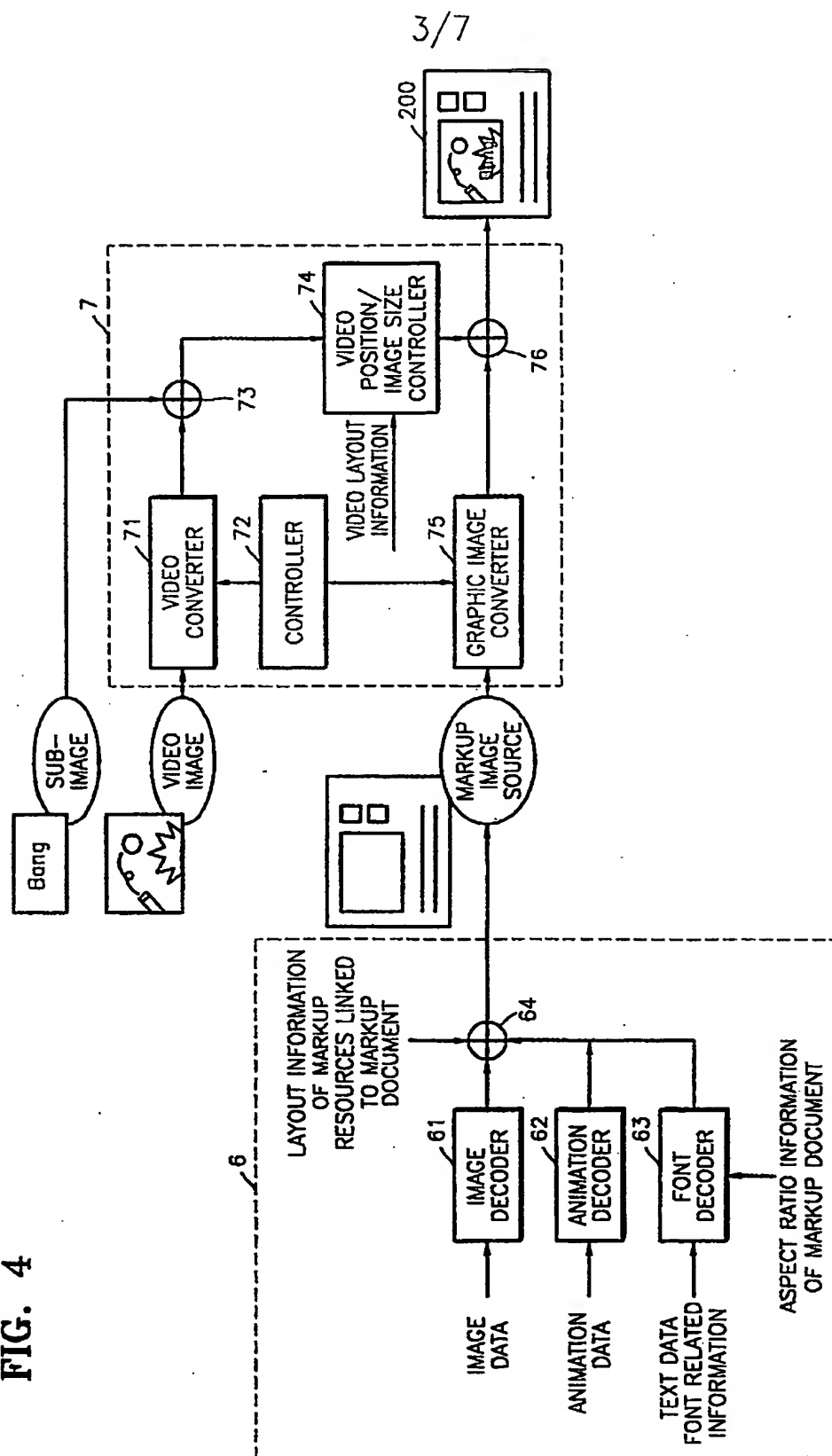


FIG. 4





4/7

FIG. 5

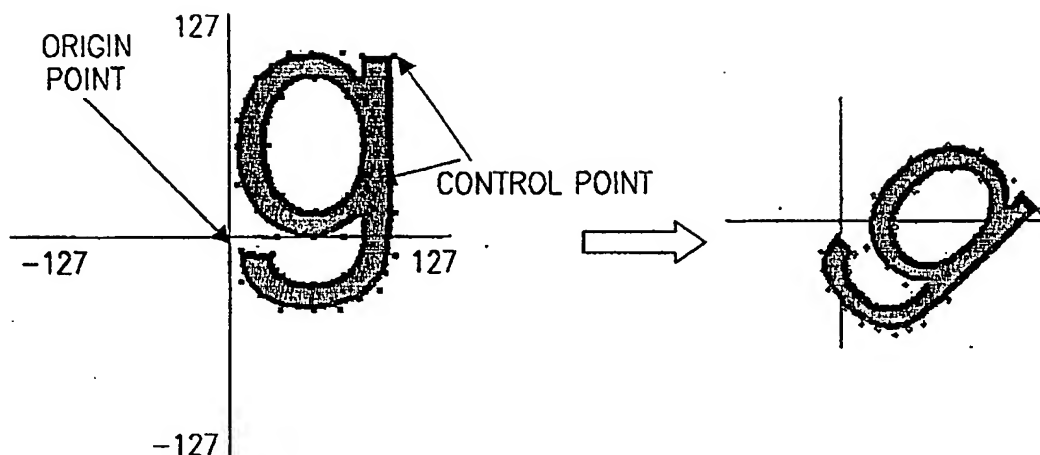


FIG. 6A

WHEN 1:1 FONT IS OUTPUT TO SCREEN  
HAVING PIXEL ASPECT RATIO OF  
0.888:1 (I.E., SCREEN HAVING  
RESOLUTION OF 720x480 AND SCREEN  
ASPECT RATIO OF 4:3) WITHOUT  
BEING CONVERTED

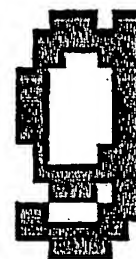
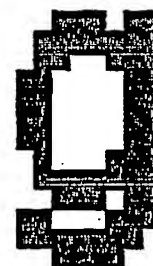
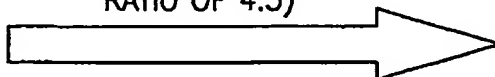
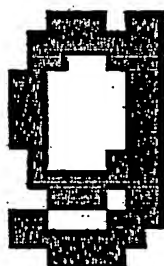


FIG. 6B

WHEN 1:1 FONT IS ENLARGED USING  
MATRIX INFORMATION AND THEN  
OUTPUT TO SCREEN HAVING PIXEL  
ASPECT RATIO OF 0.888:1  
(I.E., SCREEN HAVING RESOLUTION OF  
720x480 AND SCREEN ASPECT  
RATIO OF 4:3)



5/7

FIG. 7A

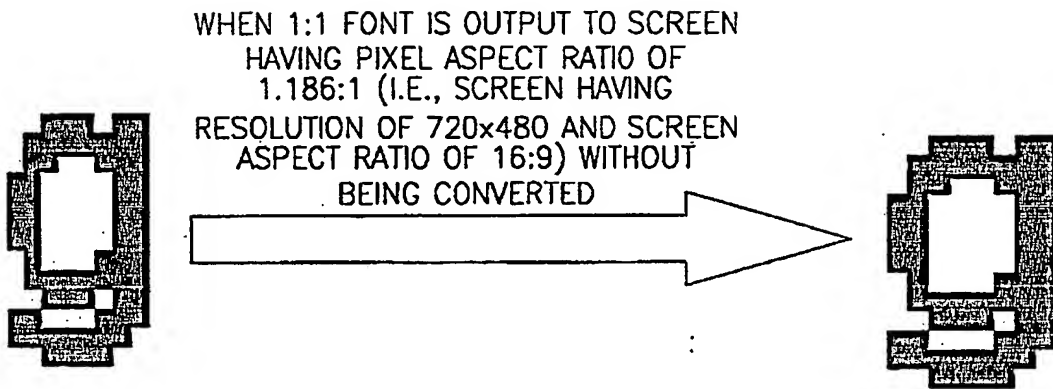
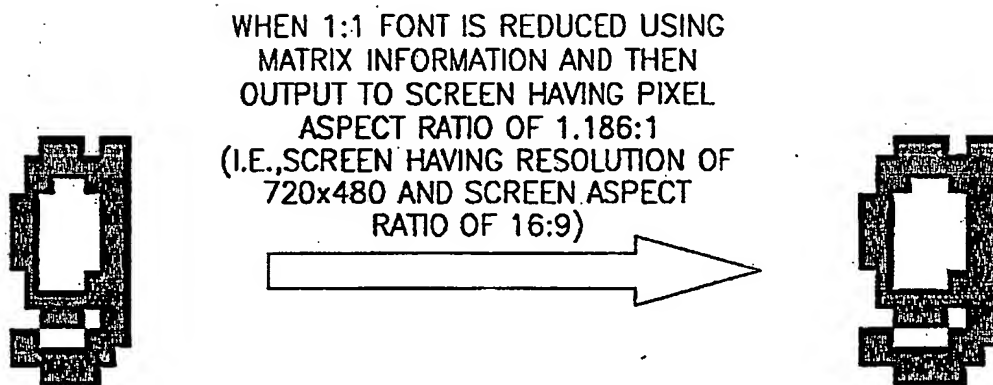
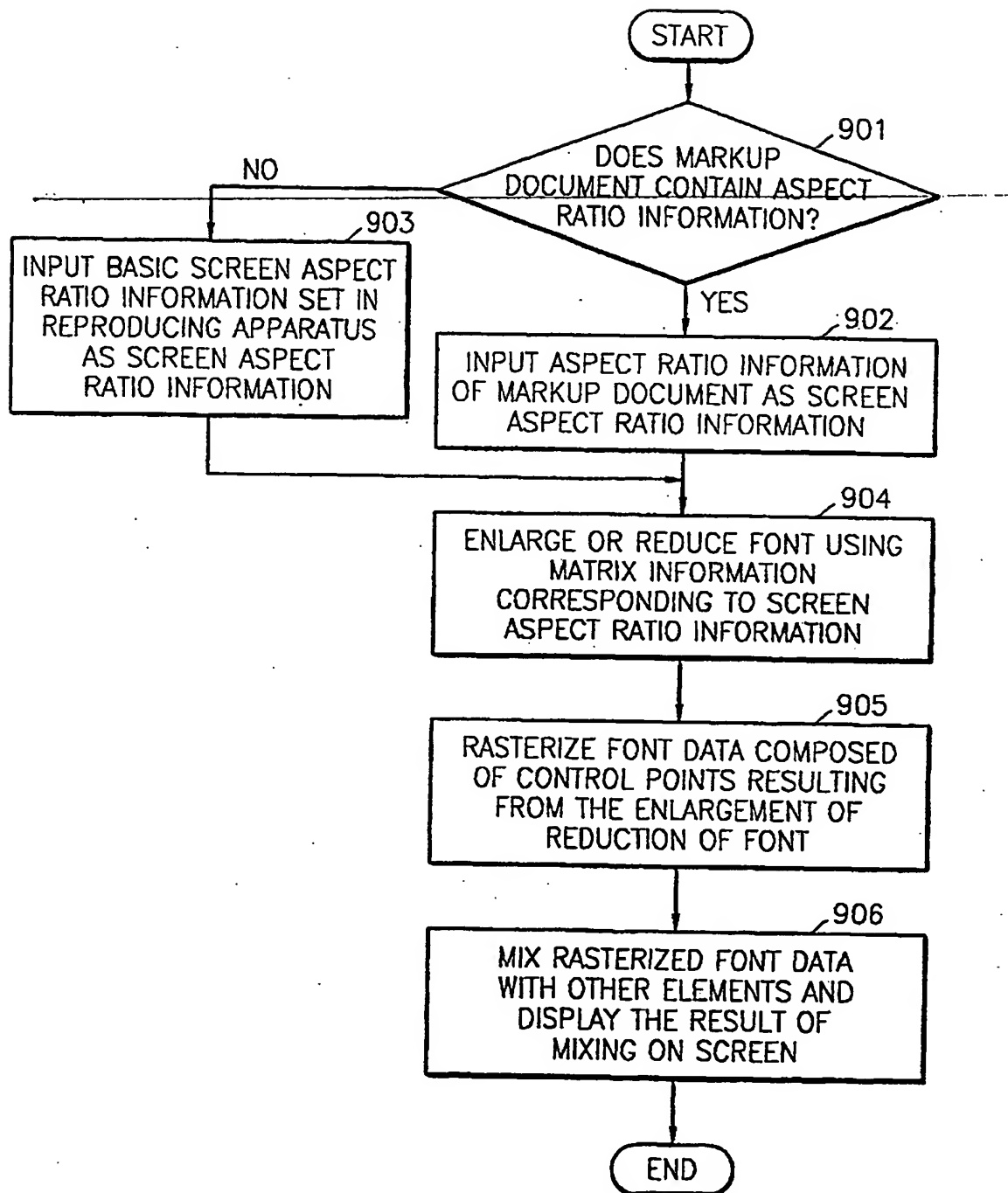


FIG. 7B



7/7

FIG. 9



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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR2003/002573

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04N 7/01

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int. Cl.6 G11B 27/31, H04N 5/45, Int. Cl.7 G06F 17/21, H04N 5/445

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
KR IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
cKIPASS "INTERACTIVE", "CONTENTS", "FONT", "ASPECT"

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 1998-049262 A(LG Electronics Inc.), 15 September 1998, Family None, -See the whole document	1-23
A	KR 1999-0177698 B1((LG Electronics Inc.), 01 May 1999, Family None, -See the whole document	1-23
A	US 6,167,410 A(Casio Computer Co., Ltd.), 26 December 2000, Family -See the whole document	1-23
A	JP 2000-23061 A(Sony Corporation), 21 January 2000, Family -See the whole document	1-23

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

- \* Special categories of cited documents:
- "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
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  - "P" document published prior to the international filing date but later than the priority date claimed
  - "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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  - "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  - "&" document member of the same patent family


Date of the actual completion of the international search

13 FEBRUARY 2004 (13.02.2004)

Date of mailing of the international search report

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
PCT/KR2003/002573

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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KR 1999-0177698 B1	01 May 1999	None	
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JP 2000-23061 A	21 January 2000	KR 2000011402 A US 6275267 BA CN 1249619 A CN 1121786 B	25-02-2000 14-08-2001 05-04-2000 17-09-2003